Analysis Report on Inspecting MQTT

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May 11, 2018

1 Analysis on Handshakes under Different QoS

Figure 1 shows the required screenshots. QoS defines the handshake of the sending and receiving of one message between the sender and receiver, which both can be either broker or devices. For each QoS level, an explanation of its handshake are given as follow.

1. QoS = 0

   The application message is delivered according to the best efforts of the underlying TCP/IP network and sender would discard the application message once sent out.

   Hence, the application message will arrive at receiver at most once.

2. QoS = 1

   After application message sent, sender waits for an acknowledgement (PUBACK or Publish Ack) to make sure the application message is received. To match PUBACK with corresponding application message, each application message at this QoS level has an ID. After PUBACK received, application message can be safely discarded.

   After a predefined time without returning PUBACK for the application message, sender will re-send application message with its DUP flag set, meaning this is duplicate.

   Hence, the application message will arrive at receiver at least once.

3. QoS = 2

   After application message sent, sender waits for an acknowledgement (PUBREC or Publish Received) to ensure application message is received and then responds with a further acknowledgement (PUBREL or Publish Release) to acknowledge that it knows application message is received. Afterwards, sender still needs to wait for one more acknowledgement (PUBCOMP or Publish Complete) from receiver so that sender is sure that receiver has received the PUBREL. Finally, the application message can be safely discarded.

   After a predefined time without the expecting message, the protocol (either sender or receiver) will retry from the last unacknowledged message.

   Hence, the application message will arrive at receiver exactly once.

No.	Time	Source	Destination	Protoc	Length	Info
4	0.077017…	150.203.213.195	52.65.194.50	MQTT	118	Connect Command
6	0.158035…	52.65.194.50	150.203.213.195	MQTT	72	Connect Ack
8	0.158642…	150.203.213.195	52.65.194.50	MQTT	90	Subscribe Request
10	0.324578…	52.65.194.50	150.203.213.195	MQTT	73	Subscribe Ack
12	0.405582…	52.65.194.50	150.203.213.195	MQTT	92	Publish Message
14	0.982773…	52.65.194.50	150.203.213.195	MQTT	90	Publish Message
16	1.966636…	52.65.194.50	150.203.213.195	MQTT	90	Publish Message
18	1.967216…	150.203.213.195	52.65.194.50	MQTT	70	Disconnect Req

(a) QoS = 0

No.	Time	Source	Destination	Protoc	Length	Info
4	0.035038…	150.203.213.195	52.65.194.50	MQTT	118	Connect Command
6	0.116371…	52.65.194.50	150.203.213.195	MQTT	72	Connect Ack
8	0.117783…	150.203.213.195	52.65.194.50	MQTT	90	Subscribe Request
9	0.197431…	52.65.194.50	150.203.213.195	MQTT	73	Subscribe Ack
11	0.278441…	52.65.194.50	150.203.213.195	MQTT	94	Publish Message
13	0.279013…	150.203.213.195	52.65.194.50	MQTT	72	Publish Ack
15	0.855686…	52.65.194.50	150.203.213.195	MQTT	92	Publish Message
16	0.855944…	150.203.213.195	52.65.194.50	MQTT	72	Publish Ack
18	1.918678…	52.65.194.50	150.203.213.195	MQTT	92	Publish Message
19	1.919294…	150.203.213.195	52.65.194.50	MQTT	72	Publish Ack
20	1.919525…	150.203.213.195	52.65.194.50	MQTT	70	Disconnect Req

(b) QoS = 1

No.	Time	Source	Destination	Protoc	Length	Info
4	0.012693…	150.203.213.195	52.65.194.50	MQTT	118	Connect Command
6	0.093942…	52.65.194.50	150.203.213.195	MQTT	72	Connect Ack
8	0.094997…	150.203.213.195	52.65.194.50	MQTT	90	Subscribe Request
9	0.175283…	52.65.194.50	150.203.213.195	MQTT	73	Subscribe Ack
11	0.260731…	52.65.194.50	150.203.213.195	MQTT	94	Publish Message
13	0.261244…	150.203.213.195	52.65.194.50	MQTT	72	Publish Received
14	0.341834…	52.65.194.50	150.203.213.195	MQTT	72	Publish Release
15	0.342358…	150.203.213.195	52.65.194.50	MQTT	72	Publish Complete
17	0.996354…	52.65.194.50	150.203.213.195	MQTT	92	Publish Message
18	0.996784…	150.203.213.195	52.65.194.50	MQTT	72	Publish Received
20	1.076962…	52.65.194.50	150.203.213.195	MQTT	72	Publish Release
21	1.077539…	150.203.213.195	52.65.194.50	MQTT	72	Publish Complete
23	2.064348…	52.65.194.50	150.203.213.195	MQTT	92	Publish Message
24	2.064815…	150.203.213.195	52.65.194.50	MQTT	72	Publish Received
26	2.145230…	52.65.194.50	150.203.213.195	MQTT	72	Publish Release
27	2.145740…	150.203.213.195	52.65.194.50	MQTT	70	Disconnect Req

(c) QoS = 2

Figure 1: Figures of MQTT handshake under different QoS. The client disconnects the broker after receives three messages.

As listed above, those assisting messages that is not compulsory for application to meets its specification can transmit on QoS level 0; whereas those key messages, which may results in deviation from the specification if not received, should transmit under QoS level 1; while some important messages whose not only payload but also occurrence matter should transmit under QoS level 2 because duplicate messages are not applicable under this circumstance.